Rulison Site

U.S. Department of Energy
Office of Legacy Management

Presentation to
Colorado Oil and Gas Conservation Commission

July 15, 2009

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DOE Activities Since the October 2007 COGCC Meeting in Grand Junction

- Contributed to the industry Sampling and Analysis Plan (SAP)
- Developing a DOE monitoring plan
- Sampled gas and water wells
- Prepared a modeling addendum
- Attended various meetings with State agencies, Garfield County representatives, gas operators, and landowners
- Posted Rulison documents on the LM website
- Developed a Path Forward approach

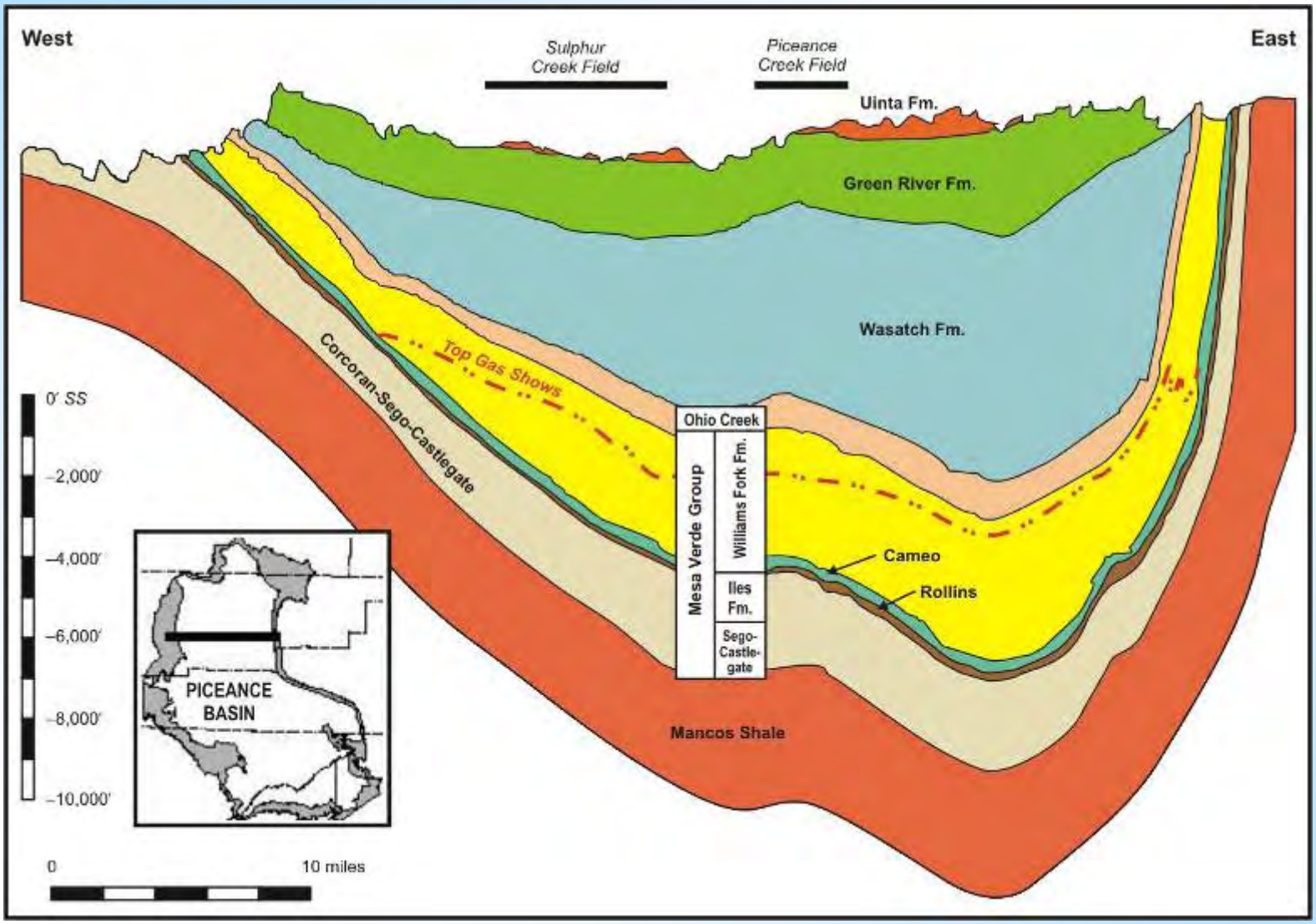
Presentation Outline

- History and Background
- DOE-LM's Role and Goal
- DOE's Understanding
- Uncertainties
- DOE's Position
- Path Forward Recommendations
- Summary of Path Forward Approach
- Other Suggested Approaches
- Available Information
- Path Forward Process
- Concluding Remarks

History and Background

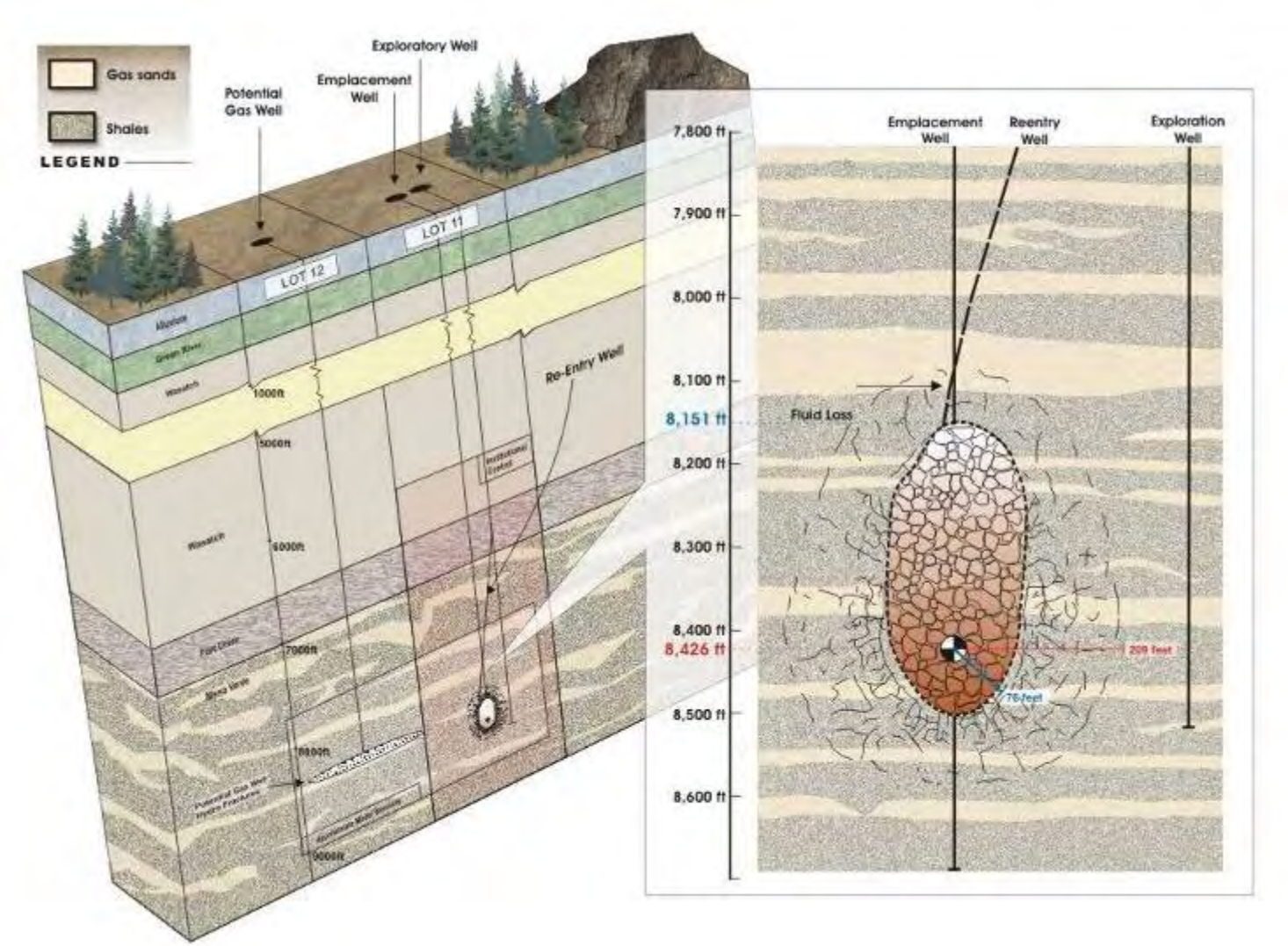
- Second natural gas reservoir stimulation experiment in Plowshare Program, which was designed to develop peaceful uses for nuclear energy
- Nuclear device detonated 8,426 feet below ground surface on September 10, 1969 in an attempt to release commercially marketable quantities of natural gas

Generalized Piceance Basin Structure and Stratigraphy

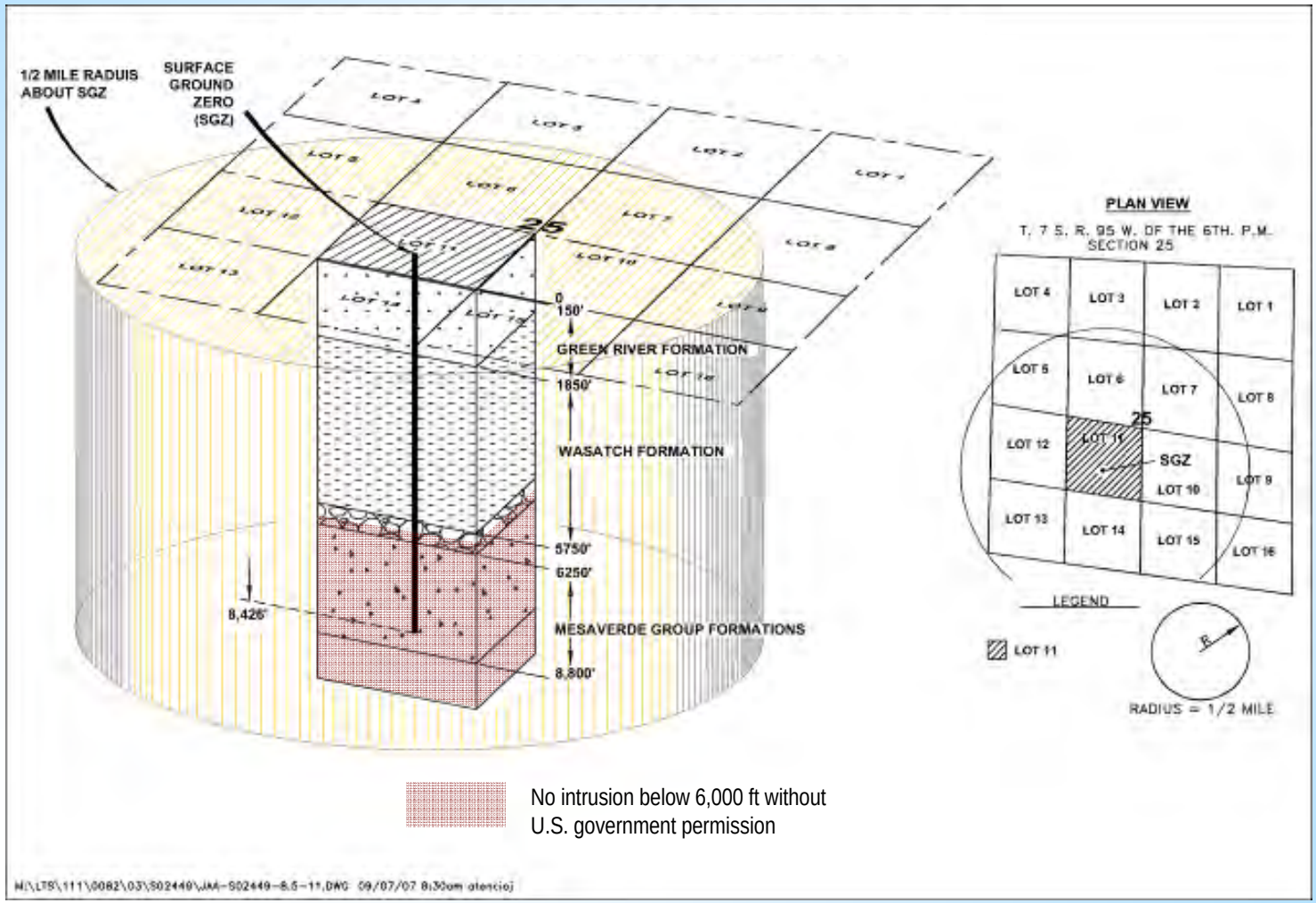


Modified from Yurewicz (2003)

Rulison Post-Detonation Cross Section



DOE Institutional Control and COGCC Hearing Boundary



DOE-LM's Role and Goal

- **DOE Office of Legacy Management**
  - **Mission:** To manage DOE's post-closure responsibilities and ensure the future protection of human health and the environment
  - **Goal 1:** Ensure protection of human health and the environment through effective and efficient long-term surveillance and maintenance
- **At Rulison**
  - Monitor water and gas for contaminants
  - Work with State agencies to provide technical recommendations
  - Provide recommendations to COGCC on Applications for Permits to Drill (APDs) within three miles of Rulison site

DOE's Understanding
Contaminant Transport

- Geologic properties of formation well known and limit movement of gas and liquid
- Size and shape of detonation cavity and chimney is based on a combination of empirical evidence and information from other detonations
- Detonation fracture extent estimated from information learned during production testing and rock mechanics
- Nature of detonation contaminants is well documented from samples of cavity gas and experience at the Nevada Test Site
- Contamination is contained within Lot 11

DOE's Understanding
Risk Evaluation

- Gas production and distribution activities remove water from the gas and would remove tritium, if present
- Potential public health risk is low because exposure pathways are unlikely
- Potential exposure pathway to workers primarily at well head and possibly production facilities, but technology exists to reduce potential exposure
- DOE is developing risk evaluation documentation and emergency response procedures

Uncertainties

- The exact subsurface conditions of the surrounding rock
- The exact size and shape of the cavity, chimney, and fractures

The amount of uncertainty does not affect the final conclusions

DOE's Position

- DOE recommends a conservative approach to drilling in the vicinity of the Rulison site
- The path forward approach was developed to guide discussions with the COGCC and natural gas operators
- Factors that DOE considered
  - Must be protective of human health and the environment
  - Some stakeholders do not want any drilling within a large area (such as three miles) surrounding the Rulison site
  - Some stakeholders want drilling and gas production near the site now
  - Natural gas must be extracted in safe manner
  - The approach must be implementable and cost effective
  - The approach must comply with State regulatory guidelines

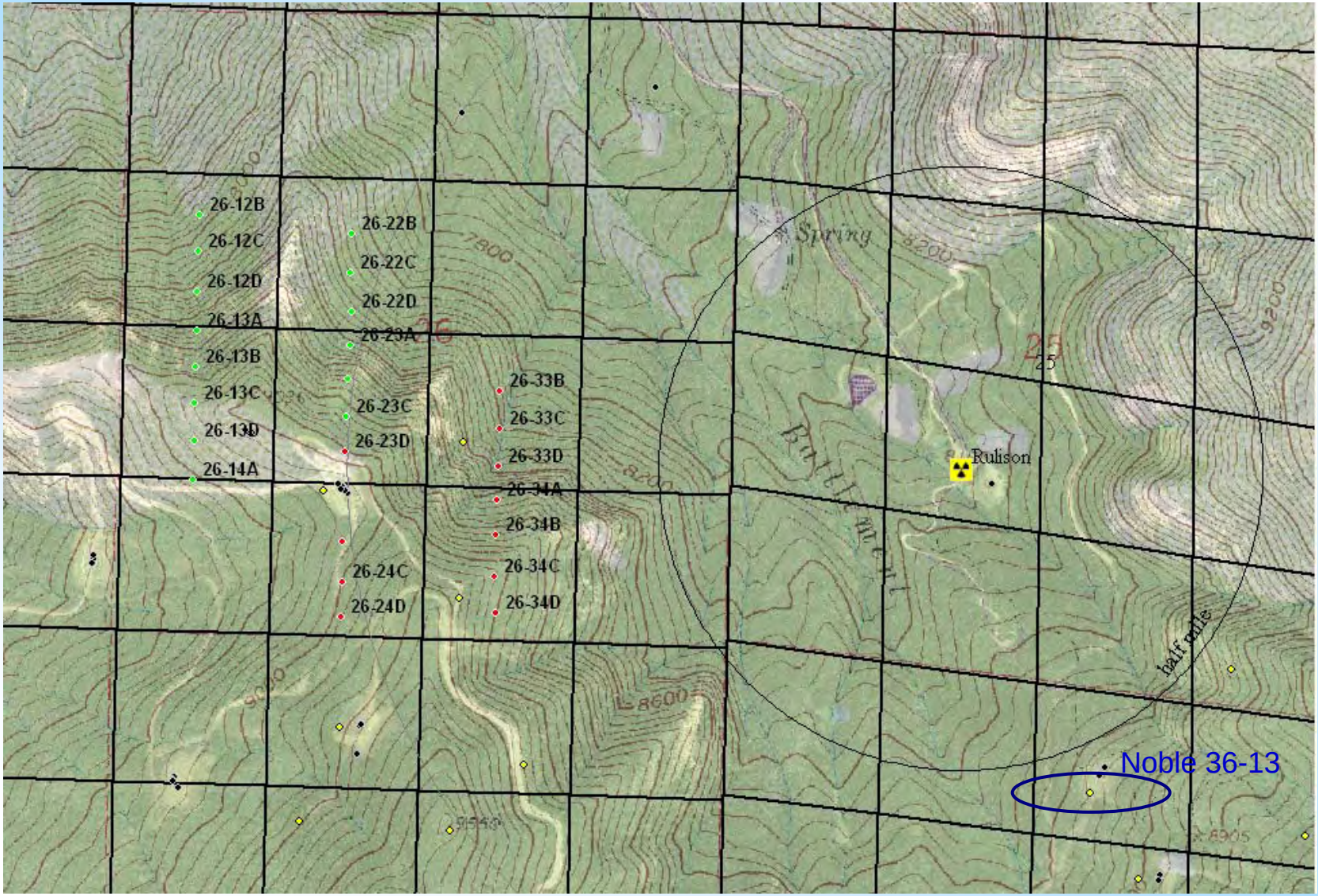
Path Forward Recommendations

- Staged approach
- Outside the half-mile hearing radius
  - First, drill and produce a series of gas wells at locations beyond and approaching the half-mile radius
  - Monitor the half-mile wells for radionuclides to confirm that they are safe
  - The half-mile wells will be drilled by gas operators as part of their planned development of gas reserves in the area
  - DOE recommends that the initial half-mile wells be installed north and south of the test site (assuming a general east-to-west natural fracture trend)

Path Forward Recommendations (continued)

- Inside the half-mile hearing radius
  - Drilling within the half-mile radius is recommended only after sampling results have confirmed the lack of radionuclides outside the half-mile radius
  - Assuming that the natural fracture trend near the site is oriented east-to-west, drilling and producing from the areas of least risk (to the north and south of the IC area) should be drilled first
  - Wells in areas of greatest risk (Lot 12, west of the site and Lot 10, east of the site) should be drilled last
  - Monitoring of wells within the half-mile radius to confirm that they are safe
- **Under no circumstances shall a well be located such that hydrofracturing into or removal of materials from Lot 11 might occur**

Current Wells in the Vicinity of Rulison



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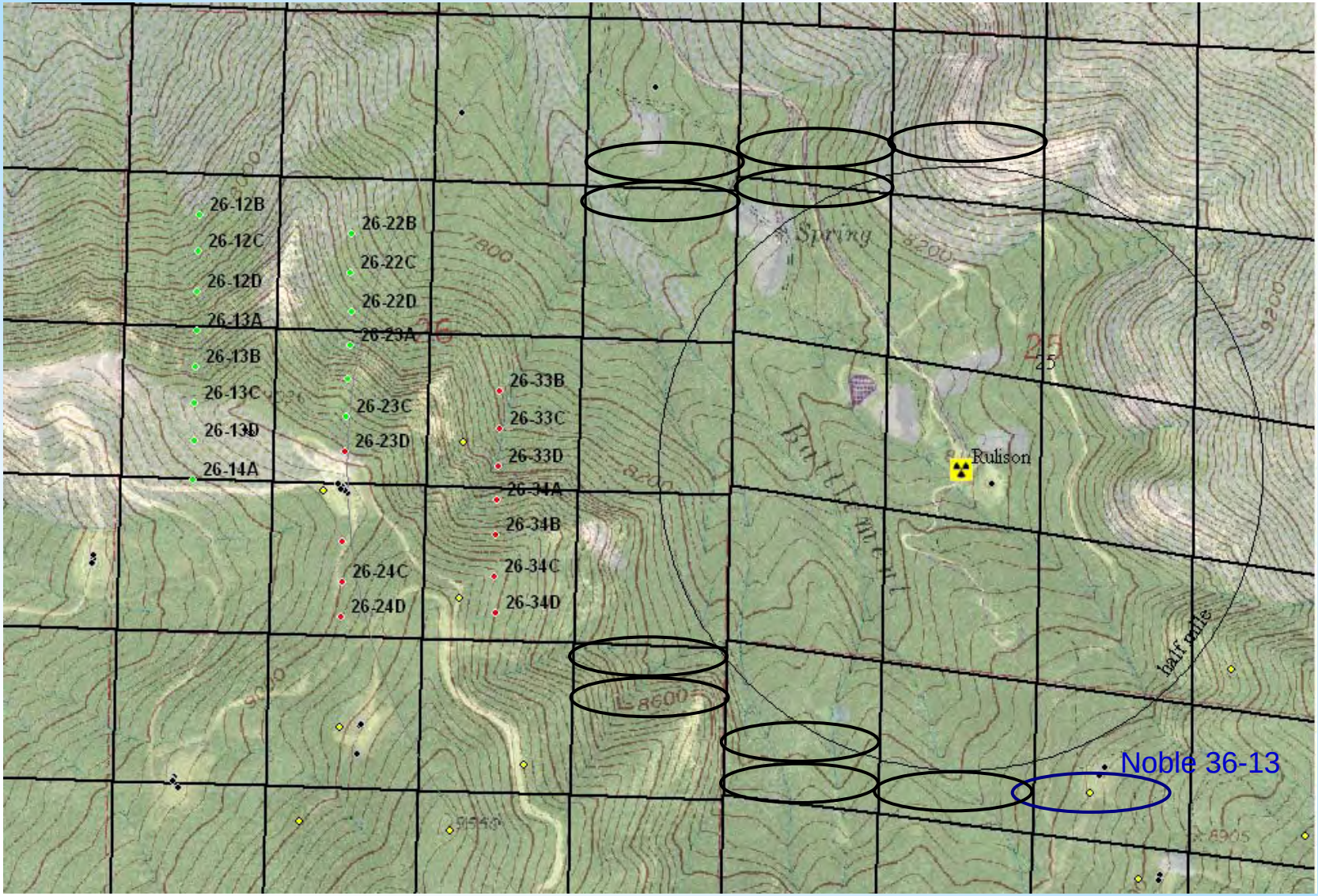
Recommended Progression of Wells



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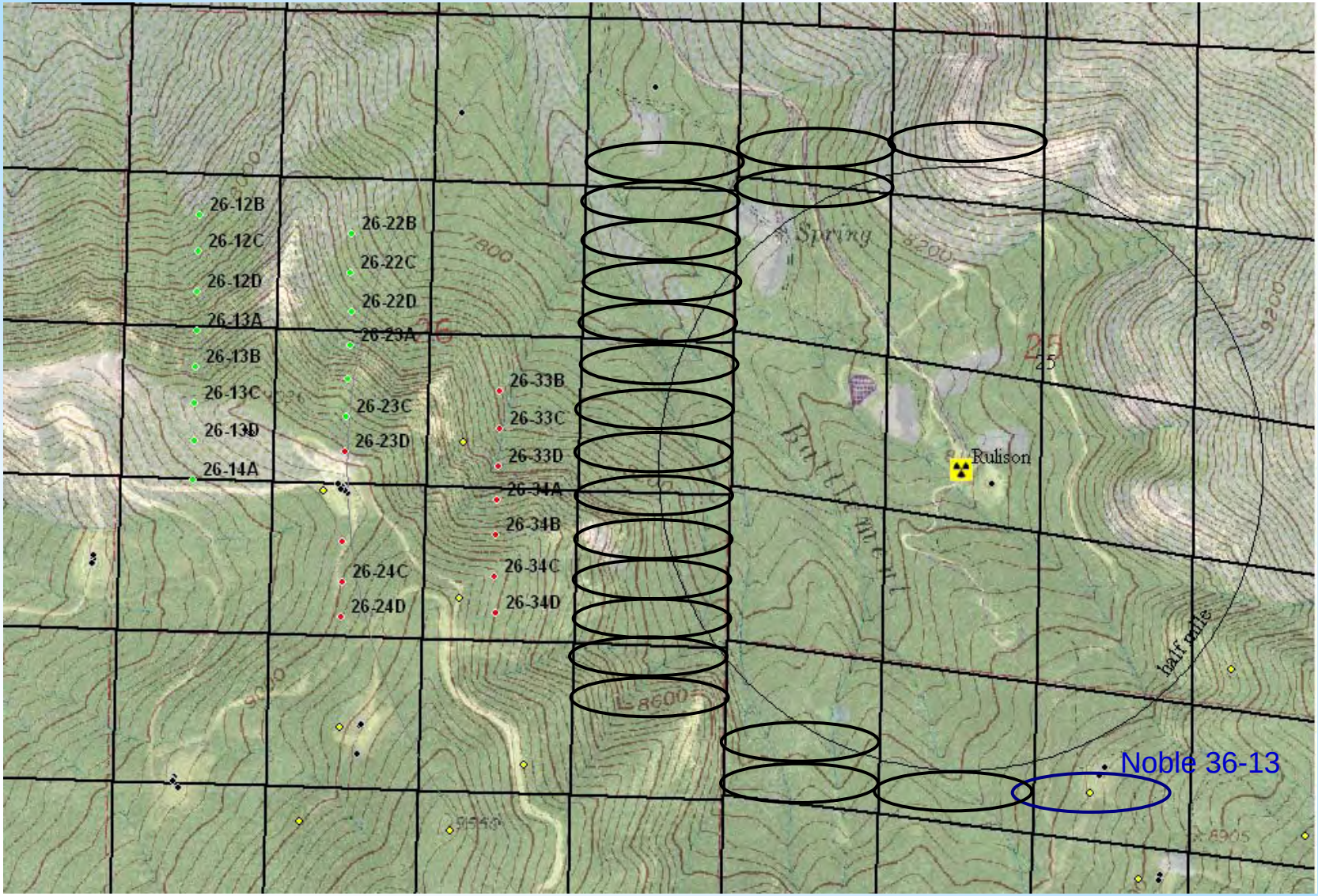

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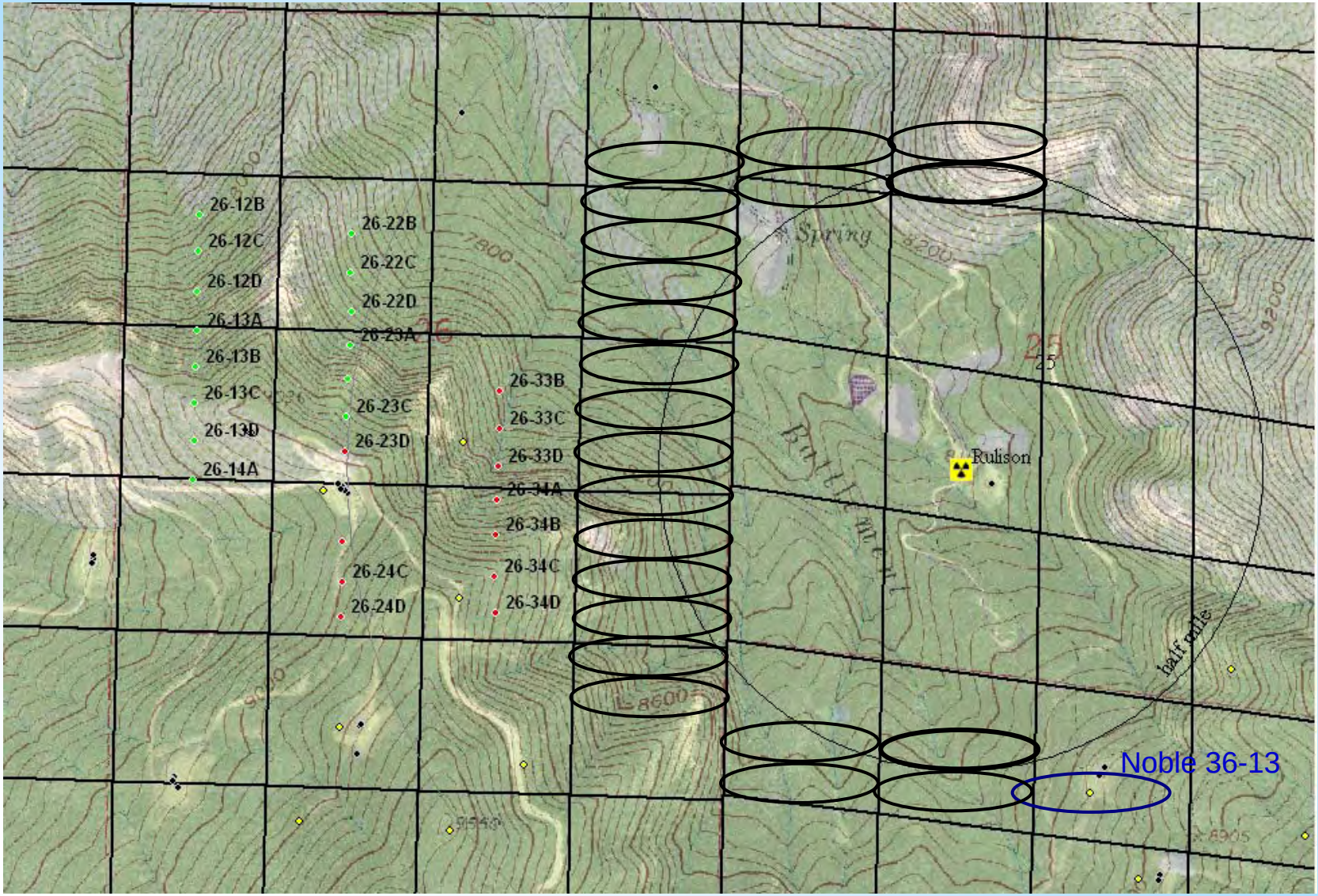
Initial Wells Inside the Half-mile Zone



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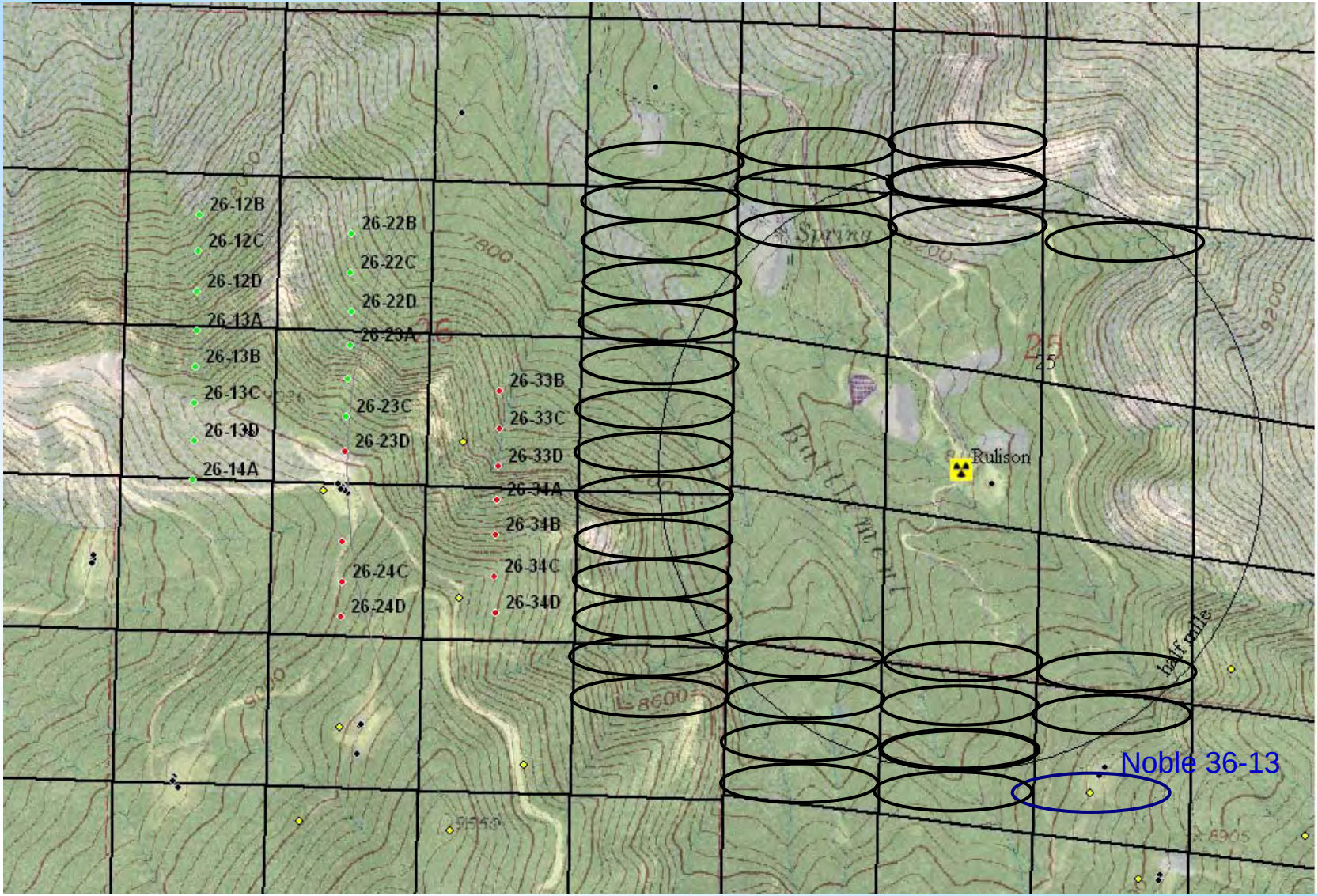

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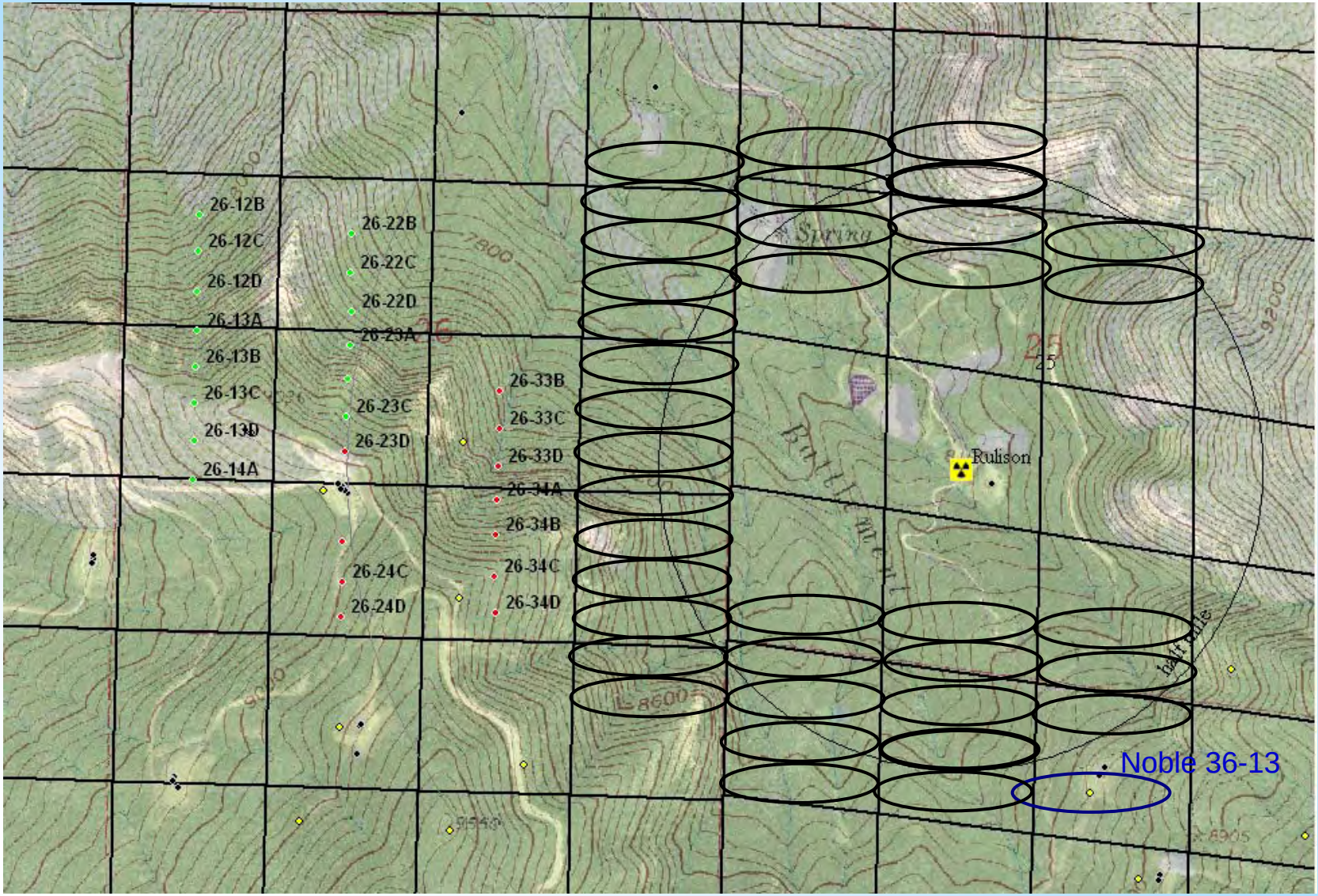

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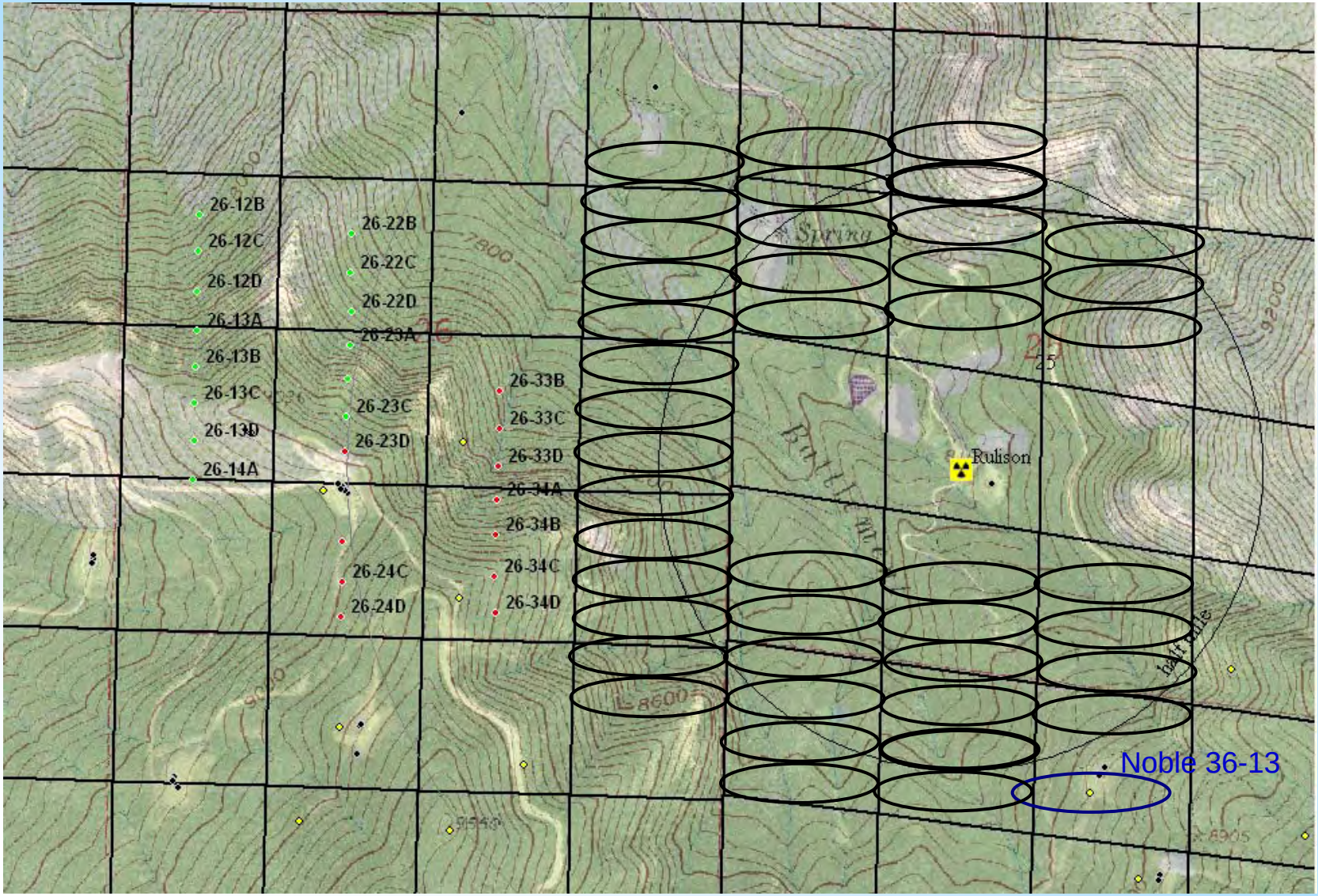

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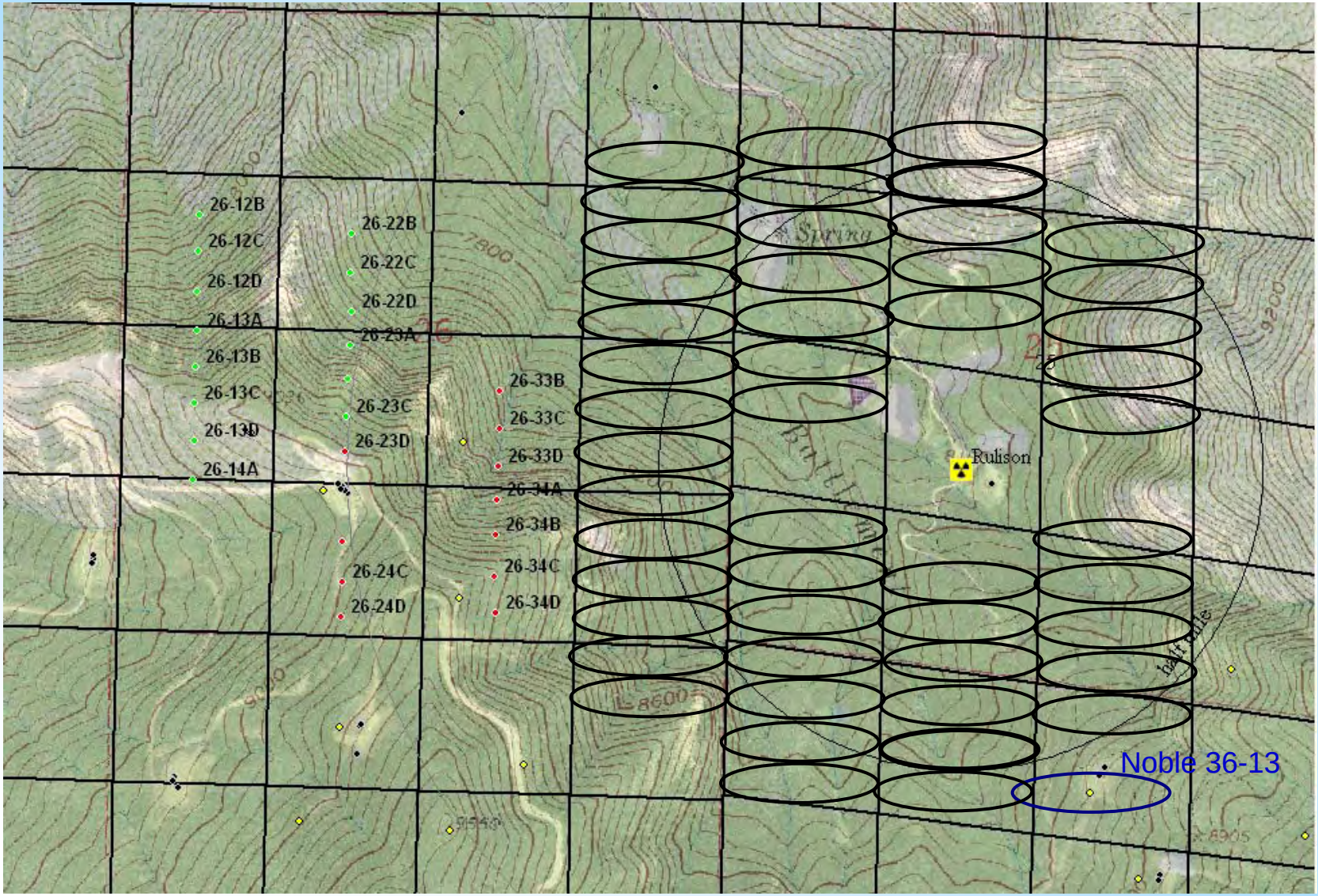

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Recommended Progression of Wells

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Summary of the Path Forward Approach

- Encourages conservative, staged development of gas reserves in the vicinity of the Rulison site
- Gas operators sequentially drill and sample wells (lowest risk locations first, higher risk locations last)
- In the unlikely event that contamination were encountered, it would be at low concentrations; risks are low and can be mitigated
- Sequential drilling can be flexible, allowing for drilling of groups of wells, rather than following a strict well-by-well sequence
- Requires cooperation of DOE, State, and industry
- Falls within the State regulatory guidelines and is implementable

Other Suggested Approaches

- Define nature and extent
- Install monitor wells
- Expand current Institutional Control

Available Information

- The LM website has links to more than 160 Rulison-related documents and a link to the DOE Office of Scientific & Technical Information where there are approximately 400 Rulison-related documents
- The few documents that remain classified are specific to the nuclear device and operation

Available Information (continued)

- Site-related documents, technical data, institutional controls information, fact sheets, presentations, and meeting announcements are available at:
- LM website
  http://www.LM.doe.gov
- Rulison Site webpage
  http://www.LM.doe.gov/land/sites/co/rulison/rulison.htm
- DOE Office of Scientific & Technical Information website
  http://www.osti.gov/
- Public Reading Rooms

Parachute Branch Library
244 Grand Valley Way
Parachute, CO 81635-9607
(970) 285-9870

U.S. Department of Energy
Office of Legacy Management
2597 B ¾ Road
Grand Junction, CO 81503
(970) 248-6089

Path Forward Process

- Available on LM website
- Comments accepted through August 14
  - E-mail comments to Rulison@LM.doe.gov
  - Fax comments to (970) 248-6040
  - Mail comments to:
    - Rulison Path Forward Comments
      U.S. Department of Energy
      2597 B ¾ Road
      Grand Junction, CO 81503
- Meet with stakeholders this fall to discuss comments
- Refine DOE Path Forward approach

Concluding Remarks

- DOE retains responsibility for any Rulison-related contamination
- DOE will
  - Continue to provide long-term monitoring of natural gas and water near the site
  - Continue to work with the State on regulatory issues
  - Encourage stakeholder involvement and communications
  - Review and comment on new drilling permits within three-mile notification zone
  - Provide technical support as required for any new wells planned within the half-mile hearing zone
  - Incorporate new data into the model as it becomes available